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## (54) System and method for integrating multiserver platforms

(57) Aspects of the invention may include a first multiserver platform comprising a network interface and/or a first switch blade. A second multiserver platform comprising a second switch blade may be coupled to the first switch blade. A third multiserver platform comprising a third switch blade may be coupled to the second switch blade of the second multiserver platform and/or the first switch blade of the first multiserver platform. The first multiserver platform, second multiserver platform and

third multiserver may be coupled in a daisy-chain configuration. Accordingly, the first multiserver platform and the third multiserver platform may communicate via the second multiserver platform. At least one central switch may be coupled to the first switch blade of the first multiserver platform and the second switch blade of the second multiserver platform. A third switch blade of a third multiserver platform may be coupled to the central switch.

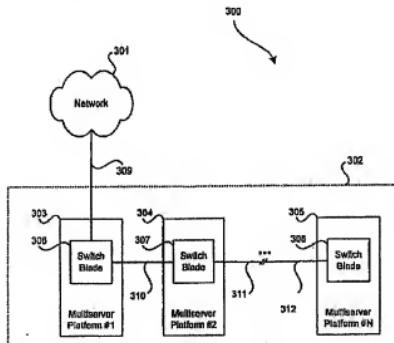


FIG. 3

**Description**

[0001] This application makes reference to, and/or claims priority to and/or claims benefit to:

United States Provisional Patent Application Serial No. 60/458,719, entitled "Method and System to Provide Inter-Chassis Blade Server Integration for Scalability" and filed on March 28, 2003;

United States Provisional Patent Application Serial No. 60/448,656, entitled "A Method and System to Provide External Communication Using a Multiserver Platform Having a Single Switch Backplane" and filed on February 18, 2003;

United States Provisional Patent Application Serial No. 60/456,831, entitled "Method and System to Provide Inter-Blade Server Communication Using a Single Switch Backplane" and filed on March 21, 2003; and

United States Provisional Patent Application Serial No. 60/463,014, entitled "Method and System to Selectively Steer Data Traffic to Service Blades Using a Single Switch Backplane" and filed on April 15, 2003.

[0002] The above stated applications are hereby incorporated herein by reference in their entirety.

**FIELD OF THE INVENTION**

[0003] Certain embodiments of the invention relate to communication among servers. More specifically, certain embodiments of the invention relate to a method and system for integrating multiserver platforms.

**BACKGROUND OF THE INVENTION**

[0004] A server may be a computer system in a network that may be accessed by one or more users and/or other computers. The server may provide, for example, access to information such as files, and to services such as communications, printing or other types of services that may be available through a network. In some cases, a special network operating system (OS) may run on a dedicated server, for example, in a large network. A personal computer (PC) operating system may run on a non-dedicated server having, for example, peer-to-peer networking software running thereon.

[0005] Generally, a server may have one or more advanced or more powerful central processing units (CPUs), a larger memory, a larger cache and more storage space than a typical single user workstation or personal computer. The server may include, for example, multiple processors which may be dedicated to a particular service or provide a particular function such as e-

mail handling, printing or communications. The server may also include devices such as, large power supplies, backup power capabilities such as an uninterruptible power supply (UPS) and various fault tolerant or redundant features such as redundant array of independent disks (RAID) technologies.

[0006] A single server may exist in a standalone enclosure and may interface with a network via one or more network interfaces. Multiple standalone boxes 10 may be situated in a central computing center with each standalone box coupled to a network via a respective cable. Each server may interface to the network separately at a particular data rate such as, for example, approximately 1 gigabit/second (Gb/s) for a Gigabit Ethernet or approximately 10 Gb/s for a 10 Gigabit Ethernet.

[0007] Thus, the single server in a standalone enclosure may inefficiently utilize large amounts of space and/or power. Furthermore, since each single server 20 may be connected to the network directly via a respective cable, a room full of servers might be overflowing with cables possibly necessitating detailed cable maps which may be quite time-intensive and costly to produce. In addition, single servers in a standalone enclosure 25 may not be easily replaced during failure, particularly when there may be multiple failures. Consequently, the conventional single server in a standalone box may ultimately suffer from a substantial total cost of ownership (TCO).

[0008] Further limitations and disadvantages of conventional and traditional approaches will become apparent to one of skill in the art, through comparison of such systems with some aspects of the present invention as set forth in the remainder of the present application with reference to the drawings.

**BRIEF SUMMARY OF THE INVENTION**

[0009] Certain embodiments of the invention provide a method and system for communicating information in a server platform. Aspects of the method for communicating information in a server platform may include receiving at least one packet from at least one of a first switch blade associated with a first multiserver platform. The method may also include determining a second server blade associated with a second multiserver platform that may receive at least a portion of the received packet. In this regard, at least a portion of the received packet may be routed to the second blade server. The packet may be received by a third switch blade and/or a central switch. In instances where the packet may be received by the central switch, at least a portion of the received packet may be communicated to the second switch blade via at least one communication link that may couple the central switch directly to the second switch blade. The routed portion of the received packet may be processed by the second blade server.

[0010] Another embodiment of the invention may pro-

vide a machine-readable storage, having stored thereon, a computer program having at least one code section for communicating information in a server platform. The at least one code section may be executable by a machine, thereby causing the machine to perform the steps as described above for communicating information in a server platform.

[0011] Aspects of the system for processing information in a multiserver platform may include a first multiserver platform having a network interface and/or a first switch blade. At least a second multiserver platform comprising a second switch blade may be coupled to the first switch blade of the first multiserver platform. A third multiserver platform comprising a third switch blade may be coupled to the second switch blade of the second multiserver platform and/or the first switch blade of the first multiserver platform. The first multiserver platform, the second multiserver platform and the third multiserver platform may be coupled in a daisy-chain configuration. In this regard, the first multiserver platform and the third multiserver platform may communicate via the second multiserver platform.

[0012] In another embodiment of the invention, at least one central switch may be coupled to the first switch blade of the first multiserver platform and the second switch blade of the second multiserver platform. At least a third switch blade of a third multiserver platform may also be coupled to the central switch. The first multiserver platform, second multiserver platform and third multiserver platform may communicate via the central switch.

[0013] According to another aspect of the invention, a method for communicating information in a server platform, the method comprises:

receiving at least one packet from at least one of a first switch blade associated with a first multiserver platform;  
 determining at least a second server blade associated with a second multiserver platform for receiving at least a portion of said received at least one packet; and  
 routing at least a portion of said at least one received packet to at least said second server blade.

[0014] Advantageously, said receiving further comprises receiving said at least one packet by at least one of a third switch blade and a central switch.

[0015] Advantageously, said at least one packet is received by said central switch, communicating said at least a portion of said at least one received packet to at least said second switch blade via at least one communication link that couples said central switch directly to said at least said second switch blade.

[0016] Advantageously, the method further comprises processing said routed at least a portion of said at least one received packet by said at least said second blade server.

[0017] According to another aspect of the invention, a machine-readable storage having stored thereon, a computer program having at least one code section for communicating information in a server platform, the at least one code section being executable by a machine for causing the machine to perform steps comprising:

10 receiving at least one packet from at least one of a first switch blade associated with a first multiserver platform;  
 determining at least a second server blade associated with a second multiserver platform for receiving at least a portion of said received at least one packet; and  
 15 routing at least a portion of said at least one received packet to at least said second server blade.

[0018] Advantageously, the machine-readable storage further comprises code for receiving said at least one packet by at least one of a third switch blade and a central switch.

[0019] Advantageously, the machine-readable storage further comprises code for communicating said at least a portion of said at least one received packet to at least said second switch blade via at least one communication link that couples said central switch directly to said at least said second switch blade, if said at least one packet is received by said central switch.

[0020] Advantageously, the machine-readable storage further comprises code for processing said routed at least a portion of said at least one received packet by said at least said second blade server.

[0021] According to another aspect of the invention, a system for communicating information in a server platform, the system comprises:

40 a first multiserver platform comprising at least one of a network interface and a first switch blade; and at least a second multiserver platform comprising a second switch blade coupled said first switch blade of said first multiserver platform.

[0022] Advantageously, the system further comprises at least a third multiserver platform comprising a third switch blade coupled to at least one of said second switch blade of said second multiserver platform and said first switch blade of said first multiserver platform.

[0023] Advantageously, said first multiserver platform, said second multiserver platform and said third multiserver are coupled in a daisy-chain configuration.

[0024] Advantageously, said first multiserver platform, and said third multiserver platform communicate via said second multiserver platform.

[0025] Advantageously, the system further comprises at least one central switch coupled to at least said first switch blade of said first multiserver platform and said second switch blade of said second multiserver platform.

[0026] Advantageously, the system further comprises at least a third switch blade of a third multiserver platform coupled to said at least one central switch.

[0027] Advantageously, said first multiserver platform, said second multiserver platform and said third multiserver platform communicate via said central switch.

[0028] These and other advantages, aspects and novel features of the present invention, as well as details of an illustrated embodiment thereof, will be more fully understood from the following description and drawings.

#### BRIEF DESCRIPTION OF SEVERAL VIEWS OF THE DRAWINGS

[0029] FIG. 1 is a block diagram of an embodiment of a multiserver platform in accordance with an embodiment of the invention.

[0030] FIG. 2 is a block diagram illustrating an embodiment of a communication system including a multiserver platform and an external network in accordance with various aspects of the invention.

[0031] FIG. 3 is a block diagram illustrating an embodiment of a communication system including an external network and N multiserver platforms coupled in a daisy-chain configuration in accordance with an embodiment of the invention.

[0032] FIG. 4 is a block diagram illustrating the coupling of two switch blades in accordance with an embodiment of the invention.

[0033] FIG. 5 is a flowchart illustrating exemplary steps for providing communication within the daisy-chain configuration of FIG. 3 in accordance with an embodiment of the invention.

[0034] FIG. 6 is a block diagram illustrating an exemplary central switch configuration for the multiserver platform of FIG. 1, in accordance with various aspects of the invention.

[0035] FIG. 7 is a flowchart illustrating exemplary steps for providing communication in the central switch configuration of FIG. 6 in accordance with an embodiment of the invention.

#### DETAILED DESCRIPTION OF THE INVENTION

[0036] Certain embodiments of the invention provide a method and system for communicating information in a server platform. Aspects of the method for communicating information in a multiserver platform may include receiving at least one packet from a first switch blade associated with a first multiserver platform. Another aspect of the method may include determining a second server blade associated with a second multiserver platform that may receive at least a portion of the received packet. In this regard, at least a portion of the received packet may subsequently be routed to the second blade server and the routed portion of the received packet processed by the second blade server. In another as-

pect of the invention, the packet may be received by a third switch blade and/or a central switch. Accordingly, in instances where the packet may be received by the central switch, at least a portion of the received packet

5 may be communicated to the second switch blade via one or more communication links that may be utilized to couple the central switch directly to the second switch blade.

[0037] FIG. 1 is a block diagram of an embodiment of 10 a multiserver platform 100 in accordance with an embodiment of the invention. The multiserver platform 100 may include a chassis 110, a backplane 130, a switch blade 140, blade server interfaces 150, and a plurality of blade servers No. 1, No. 2, ..., No. n, collectively referred to as 120.

[0038] The chassis 110 may include the backplane 130. However, although only one backplane 130 is shown, the invention is not so limited and a plurality of backplanes may be provided within the chassis 110. In 20 this regard, one or more backplanes may be coupled together. In a case where the chassis 110 may include a single backplane, the backplane may be regarded as a common backplane, which may provide connectivity for the blade servers 120. The chassis 110 may be part of a single installation enclosure that includes a plurality of blade server slots which may be adapted for receiving one or more of the blade servers 120.

[0039] The backplane 130 may include, for example, one or more blade server interfaces collectively referenced as 150, which may be referred to as blade server interconnects. In this regard, the chassis 110 may include a plurality of blade server slots that may be adapted to facilitate connection between the blade servers and the blade server interfaces 150. In other words, the blade server slots may provide a conduit for coupling the blade servers 120 to the blade server interfaces 150. The backplane 130 may also include one or more interfaces such as a network interface 160. The network interface 160 may be referred to as network interconnect.

[0040] The switch blade 140 may be part of the backplane 130. In this regard, the switch blade 140 may be integrated within the backplane 130 or it may be a plug-in card that may be plugged into the backplane 130. [0041] The blade servers 120 may be coupled to the backplane 130 via the blade server interfaces 150. Each of the blade servers 120 may therefore be coupled to a corresponding one of the server interfaces 150. For example, each of the blade servers 120 may be plugged into or removably mounted in a corresponding blade server slot in the chassis 110 so that it interfaces with a corresponding one of the server interfaces. In this regard, the blade servers 120 may be coupled to the backplane 130.

[0042] Once the blade servers 120 are mounted or 55 plugged into the chassis 110, the blade servers 120 may be coupled to the switch blade 140 of the backplane 130 via the blade server interfaces 150. The backplane 130 may be adapted to provide connectivity, for example,

between two or more of the blade servers 120. Furthermore, the backplane 130 and/or the switch blades 140 may provide connectivity between the one or more of the blade servers 120 and the network 170.

[0043] The network interface 160 facilitates connectivity between the backplane 130 and the network 170. In this regard, the network interface 160 may couple backplane 130 and/or one or more of the plurality of switch blades 140 to the network 170.

[0044] FIG. 2 is a block diagram illustrating an embodiment of a communication system 200 including a multi-server platform 201 and an external network 206, in accordance with various aspects of the invention. The multi-server platform 201 may include a chassis having a common backplane 211, a common switch-blade 202 and a plurality of blade servers including, a blade server #1 203, a blade server #2 204, ..., blade server #N 205, where N may be any integer number.

[0045] Each of the blade servers #1, #2, ..., #N may be a server that has been integrated on a single plug-in card or blade that may be plugged into a blade server slot of the chassis with the common backplane 211. The chassis with a common backplane 211 may provide a single installation enclosure for the multiple blade servers #1, #2, ..., #N.

[0046] The chassis with the common backplane 211 may also serve a common interface between each blade server 203, 204, 205 and the common switch blade 202. For example, common backplane 211 may provide a common backplane interface 208 between blade server #1 203 and the common switch blade 202. Common backplane 211 may also provide a common backplane interface 209 between blade server #2 204 and the common switch blade 202. Finally, common backplane 211 may provide a common backplane interface 210 between blade server #N 205 and the common switch blade 202. In this regard, the common backplane interfaces 208, 209, 210 are part of the common backplane 211.

[0047] The common switch blade 202 may include N+1 interfaces and at least a portion of these interfaces may be adapted to perform packet switching of data frames between the N blade servers and the external network 206, in accordance with an embodiment of the invention. The common switch-blade may include intelligence that may manage and distribute data traffic to the relevant blade servers including blade server #1, #2, ..., #N. The common switch-blade 202 may interface with each of the N blade servers via the common backplane 211. The common switch-blade 202 may also interface with the external network 206, thereby resulting in N+1 interfaces.

[0048] In accordance with an embodiment of the invention, the external network 206 may include a 10 Gigabit Ethernet network connection and interface. The external interface 207 between the common switch blade 202 and the external network 206 may include a 10 Gigabit Ethernet (GbE) interface, operating at a data

rate of 10 Gb/s. In this regard, bi-directional network communication capability may be provided between the external network 206 and the common switch blade 202. In order to facilitate Gigabit Ethernet communication, the common backplane 211 may include a plurality of Gigabit Ethernet (GbE) interfaces.

[0049] The switch blade 202 may communicate with each of the N blade servers independently over the common backplane 211 at a data rate of 1 Gb/s. For example, the blade server #1 203 may communicate in a bi-directional manner with the common switch-blade 202 via the common backplane interface 208. The blade server #2 204 may also communicate in a bi-directional manner with the common switch blade 202 via the common backplane interface 209. Finally, the blade server #N 205 may communicate in a bi-directional manner with the common switch blade 202 via the common backplane interface 210.

[0050] In accordance with an embodiment of the invention, the common switch blade 202 may have the capability to handle communication with the multiple blade servers 203, 204, 205 at the same time. In this regard, the common blade server 202 may facilitate the simultaneous transfer of information between any of the blade servers 203, 204, 205.

[0051] FIG. 3 is a block diagram illustrating an embodiment of a communication system 300 including an external network 301 and N multi-server platforms coupled in a daisy-chain configuration in accordance with an embodiment of the invention. The daisy-chain configuration includes N multi-server platforms referenced as 303, 304, ..., 305 and labeled as multi-server platform #1, multi-server platform #2, ..., multi-server platform #N, respectively. Referring to FIG. 3, the multi-server platform #1 303 may include a common switch blade 306. The multi-server platform #2 304 may include a common switch blade 307 and the multi-server platform #N 305 includes a common switch blade 308.

[0052] The external network 301 may interface with the switch blade 306 of the multi-server platform #1 303 via, for example, a high speed communication link 309. The multi-server platform #1, multi-server platform #2, ..., multi-server platforms #N referenced as 303, 305, ..., 305 may be coupled together in a daisy-chained arrangement via, for example, high speed communication links. For example, the switch blade 306 of the multi-server platform #1 303 may interface with the switch blade 307 of the multi-server platform #2 via a high speed communication link 310. The switch blade 307 of the multi-server platform #2 304 may also interface with the switch blade of another multi-server platform via a high speed communication link 311. The switch blade 308 of the multi-server platform #N 305 may also interface with the switch blade of some other multi-server platform via a high speed communication link 312.

[0053] The high speed communication links 309, 310, 311, ..., 312 may be bi-directional communication links although the invention is not so limited. In accordance with an embodiment of the invention, the high speed

communication links may be of the order of 1-10 Gigabit per second or higher and may be Ethernet links. Notwithstanding, the high speed communication links may be fibre channel links or other type of communication link, for example. Also, in accordance with an embodiment of the invention, the switch blades 306, 307, ..., 308 of the multiserver platforms may be adapted to simultaneously communicate with each other via the high speed communication links. Similarly, the switch blade 306 may be adapted to communicate with the external network 301 and the switch blade 307 at the same time over the high speed communication links 309 and 310. In this regard, information may be simultaneously transferred by the switch blades 306, 307, ..., 308 among the multiserver platforms 303, 304, ..., 305 and the external network 30. The data communication rate between any of the multiserver platforms 303, 304, ..., 305 may be any standard or non-standard data rate, in accordance with various embodiments of the invention.

[0053] FIG. 4 is a block diagram illustrating the coupling of two switch blades in accordance with an embodiment of the invention. Referring to FIG. 4, there is shown a first multiserver platform 402 coupled to a second multiserver platform 422. In this regard, reference 402 may include an enclosure or chassis of the first multiserver platform 402 and reference 422 may include an enclosure or chassis of the multiserver platform 422. Notwithstanding, the first multiserver platform 402 may include a backplane 404, a plurality of  $n$  blade servers collectively referred to as 406, a switch blade 408 and a bus 411. Also shown are bus transceivers 410, 412, 414, 416 and a controller 418. Each of the bus transceivers 410, 412, 414, 416 may include at least one transmitter that may transmit electrical signals onto the bus 411 within the backplane 404. Each of the bus transceivers 410, 412, 414, 416 may also include at least one receiver that may receive electrical signals onto the bus 411 within the backplane 404. The bus 411 may be a time division multiplexed (TDM) bus, a frequency division multiplexed (FDM) bus, or any other suitable type of bus. Accordingly, the bus transceivers 410, 412, 414, 416 may be suitable time division multiplexed bus transceivers and/or frequency division multiplexed bus transceivers, for example. A communication link 440 may couple the first multiserver platform 402 to the second multiserver platform 422. The communication link 440 may be similar to the communication links that couple the multiserver platform #1, multiserver platform #2, ..., multiserver platform #N referenced as 303, 304, ..., 305 in the daisy-chain arrangement of FIG. 3.

[0054] Each of the blade servers 406 and the switch blade 408 of the first multiserver platform 402 may include a bus transceiver that may be coupled to the bus 411. In this regard, blade server No. 1 includes a bus transceiver 410, server blade No. 2 includes a bus transceiver 412, and server blade No.  $n$  includes a bus transceiver 414. The switch blade 408 may also include a bus transceiver 418 and a bus controller 418. Although the

bus controller 418 is illustrated as a separate entity within the switch blade 408, the invention is not so limited. Accordingly, one or more functions provided by the bus controller 418 may be provided by the switch blade 408. In a case where all of the functions offered by the bus controller may be provided by the switch blade, this may eliminate a need for an additional bus processing entity such as the bus controller 418.

[0055] Notwithstanding, the bus controller 418 and/or the switch blade 408 of the first multiserver platform 402 may be adapted to control the transfer of messages between the blade servers 406 and the switch blade 408. In this regard, the bus controller 418 may handle functions such as bus access and bus arbitration. The bus controller 418 and/or the switch blade 408 may also provide a switching function that may permit messages to be transferred among the blade servers 406 via the switch blade and from an external source such as the network 170 (FIG. 1) to any one or more of the blade servers 406. For example, one or more messages received from the network 170 may be steered by the switch blade 408 to one or more of the blade servers 406 based on a message type and a function provided by one or more of the blade servers 406. United States Patent Application Serial No.

(Attorney Docket No. 14221 US02) filed August 26, 2003, discloses a method and system for selective steering of data traffic of various data types to functionally dedicated blade servers which application is incorporated herein by reference in its entirety.

[0056] The bus controller 418 and/or the switch blade 408 of the first multiserver platform 402 may include suitable hardware and/or software that may be adapted to control, for example, bus access, bus arbitration and/or switching among the blade servers 406 and the switch blade 408. The hardware and/or software may therefore control the manner in which messages may be received from a first blade server and transferred, routed or switched to a second blade server via the switch blade 408.

[0057] The second multiserver platform 422 may include a backplane 424, a plurality of  $n$  blade servers collectively referred to as 426, a switch blade 428 and a bus 431. Also shown are bus transceivers 430, 432, 434, 436 and a controller 438. Each of the bus transceivers 430, 432, 434, 436 may include at least one transmitter that may transmit electrical signals onto the bus 431 within the backplane 424. Each of the bus transceivers 430, 432, 434, 436 may also include at least one receiver that may receive electrical signals onto the bus 431 within the backplane 424. The bus 431 may be a time division multiplexed (TDM) bus, a frequency division multiplexed (FDM) bus, or any other suitable type of bus. Accordingly, the bus transceivers 430, 432, 434, 436 may be suitable time division multiplexed bus transceivers and/or frequency division multiplexed bus transceivers, for example.

[0058] Each of the blade servers 426 and the switch

blade 428 of the second multiserver platform 422 may include a bus transceiver that may be coupled to the bus 431. In this regard, blade server No. 1 includes a bus transceiver 430, server blade No. 2 includes a bus transceiver 432, and server blade No. n includes a bus transceiver 434. The switch blade 428 may also include a bus transceiver 436 and a bus controller 438. Although the bus controller 438 is illustrated as a separate entity within the switch blade 428, the invention is not so limited. Accordingly, one or more functions provided by the bus controller 438 may be provided by the switch blade 428. In a case where all of the functions offered by the bus controller may be provided by the switch blade, this may eliminate a need for an additional bus processing entity such as the bus controller 438.

[0059] Notwithstanding, the bus controller 438 and/or the switch blade 428 of the second multiserver platform 422 may be adapted to control the transfer of messages between the blade servers 426 and the switch blade 428. In this regard, the bus controller 438 may handle functions such as bus access and bus arbitration. The bus controller 438 and/or the switch blade 428 may also provide a switching function that may permit messages to be transferred among the blade servers 426 via the switch blade and from an external source such as the network 170 (FIG. 1) to any one or more of the blade servers 426. For example, one or more messages received from the network 170 may be steered by the switch blade 428 to one or more of the blade servers 426 based on a message type and a function provided by one or more of the blade servers 426.

[0060] The bus controller 438 and/or the switch blade 428 of the second multiserver platform 422 may include suitable hardware and/or software that may be adapted to control, for example, bus access, bus arbitration and/or switching among the blade servers 426 and the switch blade 428. The hardware and/or software may therefore control the manner in which messages may be received from a first blade server and transferred, routed or switched to a second blade server via the switch blade 428.

[0061] FIG. 5 is a flowchart 500 illustrating exemplary steps for providing communication within the daisy-chain configuration 302 of FIG. 3 in accordance with an embodiment of the invention. Referring to FIG. 5, in step 501, a first multiserver platform may transmit a first packet of information to a second multiserver platform via a first high speed communication link. In step 502, the second multiserver platform may process the first packet and transmit a second packet of information to a third multiserver platform via a second high speed communication link. In step 503, the third multiserver platform may process the second packet and transmit a third packet of information to the second multiserver platform via the second high speed communication link. In step 504, the second multiserver platform may process the third packet and transmit a fourth packet of information to the first multiserver platform via the first

high speed communication link. In step 505, the first multiserver platform may process the fourth packet and transmit a fifth packet of information over an external network via a third high speed communication link.

5 [0062] FIG. 6 is a block diagram 600 illustrating an exemplary central switch configuration 602 for the multiserver platform of FIG. 1, in accordance with various aspects of the invention. The central switch configuration 602 may include a central switch, a switching element 40 or a switch 603, a multiserver platform #1 604, a multiserver platform #2 605, up to and including a multiserver platform #N 606. The multiserver platform #1 604 may include a common switch blade or switch blade 607. The multiserver platform #2 605 may include a switch blade 608 and the multiserver platform #N 606 may include a switch blade 609.

[0063] The external network 601 may interface with the switch blade 607 of the multiserver platform #1 604 via a high speed communication link 610. The multiserver

20 platform #1 604 may be coupled to the central switch 603 via a high speed communication link 611. The multiserver platform #2 605 may be coupled to the central switch 603 via the high speed link 612 and in a similar manner, the multiserver platform #N 606 may be coupled to the central switch 603 via the high speed communication link 613. In this regard, the switch blade 607 of the multiserver platform #1 604 may interface with the central switch 603 via the high speed communication link 611. The switch blade 608 of the multiserver platform #2 605 may connect with the central switch 603 via the high speed communication link 612. In a similar manner, the switch blade 609 of the multiserver platform #N 606 may connect to the central switch 603 via the high speed communication link 613.

25 [0064] In operation, the central switch may coordinate the high speed switching or routing of packets among the various multiserver platforms 604, 605, ..., 606. One advantage of the central switch configuration of FIG. 6 over the daisy-chain configuration of FIG. 3 is that, in

30 the central switch configuration of FIG. 6, a packet may be transmitted from any given multiserver platform 604, 605, ..., 606, through the central switch 603, to any other multiserver platform. In the daisy-chain configuration or arrangement, a packet of data may have to be passed through a plurality of intermediate multiserver platforms in order to be transferred from a source platform to a destination platform.

35 [0065] The high speed communication links 610, 611, 612, 613 may be bi-directional communication links. In accordance with an embodiment of the invention, the high speed communication links may be links of the order of 1-10 Gigabits per second. Notwithstanding, those links may be Ethernet links or fibre channel links. Also, in accordance with an embodiment of the invention, the switch blades 607, 608, 609 of the multiserver platforms 604, 605, 606 may have the capability to simultaneously communicate with the central switch 603 via the high speed communication links 611, 612, ..., 613. Similarly,

the switch blade 507 may also have the capability to communicate with the external network 601 and the central switch 603 at the same time over the high speed communication links 610 and 611. The data communication rate between any of the multiserver platforms 604, 605, ..., 606 and the central switch 403 may be any standard or non-standard data rate, in accordance with various embodiments of the invention.

[0066] FIG. 7 is a flowchart 700 illustrating exemplary steps for providing communication in the central switch configuration of FIG. 6 in accordance with an embodiment of the invention. Referring to FIG. 7, in step 701, a first multiserver platform may transmit a first packet of information to a central switch via a first high speed communication link. In step 702, the central switch may transmit the first packet to a second multiserver platform via a second high speed communication link. In step 703, the second multiserver platform may process the first packet and may transmit a second packet of information to the central switch via the second high speed communication link. In step 704, the central switch may transmit the second packet to the first multiserver platform via the first high speed communication link. In step 705, the first multiserver platform may process the second packet and may transmit a third packet of information over an external network via a third high speed communication link.

[0067] In accordance with various embodiments of the invention, the multiserver platforms may communicate data and/or control information among each other via one or more high speed communication links that may be coupled to the switch blades of the multiserver platforms and/or the central switch where present. The control information may include pertinent information related to the multiserver platforms. For example, some control information may indicate the blade server associated with a particular multiserver platform from which a particular packet may have originated. Other exemplary information may include synchronization information, security information, and provisioning and security.

[0068] In accordance with another embodiment of the invention, any one or more of the multiserver platforms may each provide a plurality of server functions. Alternatively, each of the multiserver platforms may be dedicated to providing a different, specific server function. Notwithstanding, the configurations of FIG. 3 and FIG. 6 may provide blade server scalability by utilizing at least two multiserver platforms to increase server performance and/or system capacity, for example. In this regard, multiserver platforms may be added or removed to facilitate increased and decreased traffic, respectively.

[0069] Aspects of the invention provide a method and system for inter-platform blade server integration using a plurality of multiserver platforms. The configurations of FIG. 3 and FIG. 6, for example, may provide blade server scalability using a plurality of multiserver platforms to increase server performance and/or system ca-

acity. In this regard, by integrating a plurality of multiserver platforms, a larger virtual server platform is effectively created.

[0070] In particular, for example, aspects of the system for processing information in a server platform may include a first multiserver platform 303 (FIG. 3) having at least one network interface 309 and/or a first switch blade 306. At least a second multiserver platform 304 comprising a second switch blade 307 may be coupled to the first switch blade 306 of the first multiserver platform 303. A third multiserver platform 305 comprising a third switch blade 308 may be coupled to the second switch blade 304 of the second multiserver platform 307 and/or the first switch blade 306 of the first multiserver platform 303. The first multiserver platform 303, the second multiserver platform 304 and the third multiserver platform 305 may be coupled in a daisy-chain configuration. In this regard, the first multiserver platform 303 and the third multiserver platform 305 may communicate via the second multiserver platform 304.

[0071] In another embodiment of the invention, for example, at least one central switch 603 (FIG. 6) may be coupled to the first switch blade 607 of the first multiserver platform 604 and the second switch blade 608 of the second multiserver platform 605. At least a third switch blade 609 of a third multiserver platform 606 may also be coupled to the central switch 603. The first multiserver platform 604, second multiserver platform 605 and third multiserver platform 606 may communicate via the central switch 603.

[0072] Accordingly, the present invention may be realized in hardware, software, or a combination of hardware and software. The present invention may be realized in a centralized fashion in one computer system, or in a distributed fashion where different elements are spread across several interconnected computer systems. Any kind of computer system or other apparatus adapted for carrying out the methods described herein is suited. A typical combination of hardware and software may be a general-purpose computer system with a computer program that, when being loaded and executed, controls the computer system such that it carries out the methods described herein.

[0073] The present invention may also be embedded in a computer program product, which comprises all the features enabling the implementation of the methods described herein, and which when loaded in a computer system is able to carry out these methods. Computer program in the present context means any expression, in any language, code or notation, of a set of instructions intended to cause a system having an information processing capability to perform a particular function either directly or after either or both of the following: a) conversion to another language, code or notation; b) reproduction in a different material form.

[0074] While the present invention has been described with reference to certain embodiments, it will be understood by those skilled in the art that various chang-

es may be made and equivalents may be substituted without departing from the scope of the present invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the present invention without departing from its scope. Therefore, it is intended that the present invention not be limited to the particular embodiment disclosed, but that the present invention will include all embodiments falling within the scope of the appended claims.

#### Claims

1. A method for communicating information in a server platform, the method comprising:

receiving at least one packet from at least one of a first switch blade associated with a first multiserver platform;  
 determining at least a second server blade associated with a second multiserver platform for receiving at least a portion of said received at least one packet; and  
 routing at least a portion of said at least one received packet to at least said second server blade.

2. The method according to claim 1, wherein said receiving further comprises receiving said at least one packet by at least one of a third switch blade and a central switch.

3. The method according to claim 2, further comprising if said at least one packet is received by said central switch, communicating said at least a portion of said at least one received packet to at least said second switch blade via at least one communication link that couples said central switch directly to said at least said second switch blade.

4. The method according to claim 1, further comprising processing said routed at least a portion of said at least one received packet by said at least said second blade server.

5. A machine-readable storage having stored thereon, a computer program having at least one code section for communicating information in a server platform, the at least one code section being executable by a machine for causing the machine to perform steps comprising:

receiving at least one packet from at least one of a first switch blade associated with a first multiserver platform;  
 determining at least a second server blade associated with a second multiserver platform for

receiving at least a portion of said received at least one packet; and  
 routing at least a portion of said at least one received packet to at least said second server blade.

6. The machine-readable storage according to claim 5, further comprising code for receiving said at least one packet by at least one of a third switch blade and a central switch.

7. The machine-readable storage according to claim 6, further comprising code for communicating said at least a portion of said at least one received packet to at least said second switch blade via at least one communication link that couples said central switch directly to said at least said second switch blade, if said at least one packet is received by said central switch.

8. The machine-readable storage according to claim 5, further comprising code for processing said routed at least a portion of said at least one received packet by said at least said second blade server.

9. A system for communicating information in a server platform, the system comprising:

a first multiserver platform comprising at least one of a network interface and a first switch blade; and  
 at least a second multiserver platform comprising a second switch blade coupled said first switch blade of said first multiserver platform.

10. The system according to claim 9, further comprising at least a third multiserver platform comprising a third switch blade coupled to at least one of said second switch blade of said second multiserver platform and said first switch blade of said first multiserver platform.

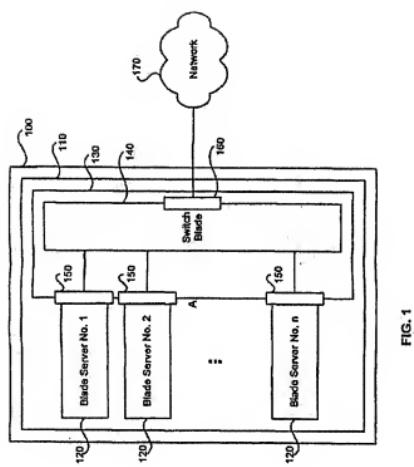


FIG. 1

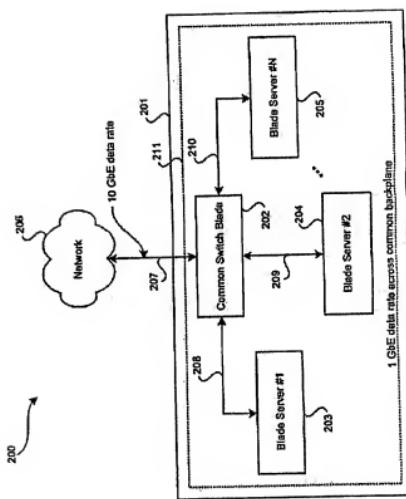


FIG. 2

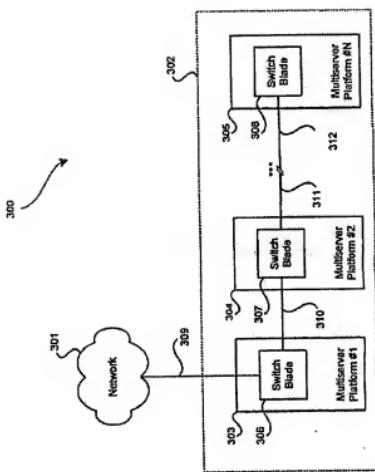


FIG. 3

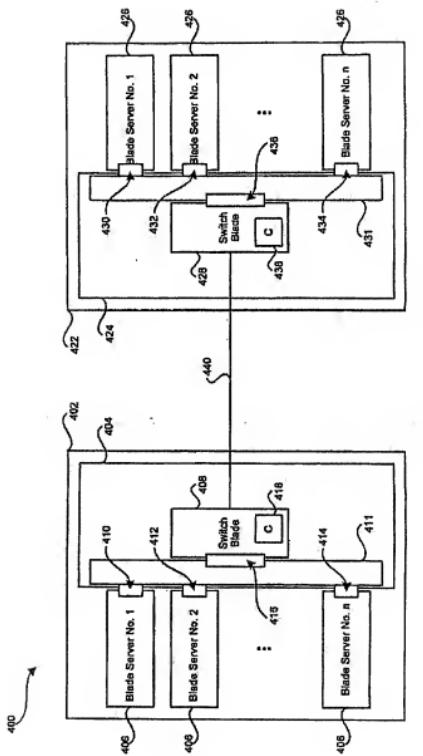


FIG. 4

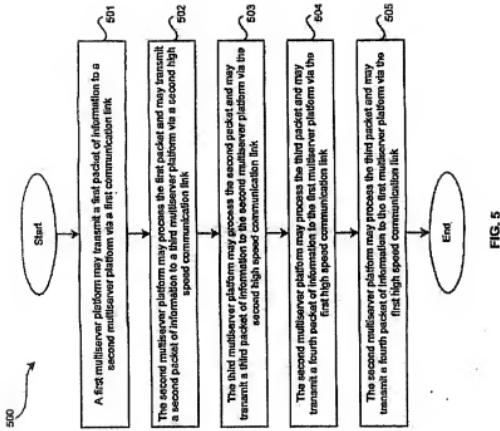


FIG. 5

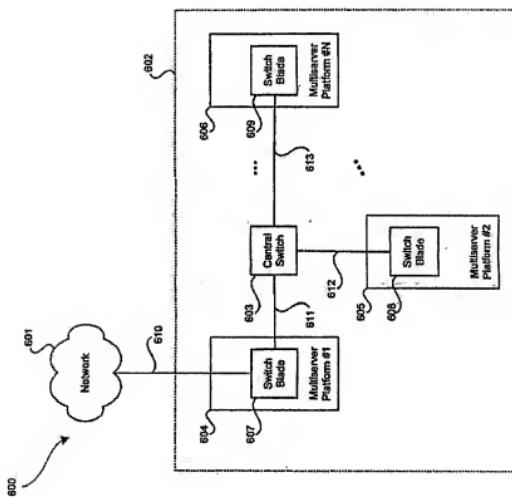


FIG. 6

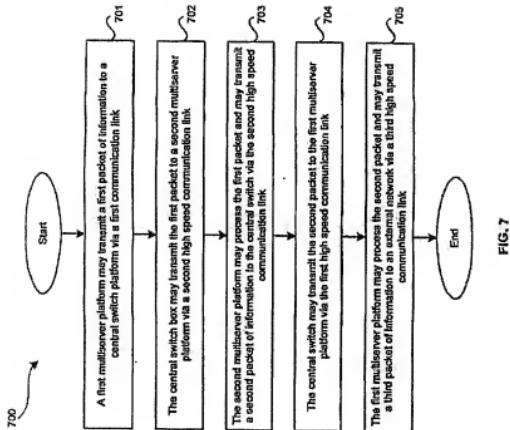


FIG. 7